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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte YOSHINORI NAGAMINE,
KOJI TSUNEKAWA, DAVID DJULIANTO DJAYAPRAWIRA,
and HIROKI MAEHARA

Appeal 2016-004101
Application 12/224,646
Technology Center 1700

Before LINDA M. GAUDETTE, MARK NAGUMO, and LILAN REN, *Administrative Patent Judges*.

Opinion for the Board by GAUDETTE, *Administrative Patent Judge*.

Opinion dissenting by NAGUMO, *Administrative Patent Judge*.

GAUDETTE, *Administrative Patent Judge*.

DECISION ON APPEAL[1]

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[1] This Decision includes citations to the following documents: Specification filed Sept. 2, 2008 ("Spec."); Final Office Action mailed Mar. 27, 2015 ("Final"); Advisory Action mailed July 23, 2015 ("Advisory Act."); Appeal Brief filed Aug. 4, 2015 ("Appeal Br."); Examiner's Answer mailed Jan. 20, 2016 ("Ans."); and Reply Brief filed Mar. 4, 2016 ("Reply Br.").

Appellants[2] appeal under 35 U.S.C. § 134(a) from the Examiner's decision finally rejecting claims 34, 36, 38, and 45. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

The "invention relates to [a] method of manufacturing a magnetoresistance effect element used for an MRAM (magnetic random access memory) or a magnetic head sensor." Spec. ¶ 1. The inventive method is said to produce a magnetoresistance effect element which achieves a high magnetoresistance ("MR") ratio even when the value of electric resistance value per 1 μm^2 ("RA") is low. Spec. ¶ 5.

The claims stand rejected under 35 U.S.C. § 103(a) as follows (*see* Final 5–9):

1. claims 34 and 45 over Djayaprawira et al. (US 2006/0056115 A1, Mar. 16, 2006 ("Djayaprawira")), Aoyanagi et al. (JP 4-132280 (English Abstract), May 6, 1992 ("Aoyanagi")), and Mauri (US 2006/0042930 A1, Mar. 2, 2006);

2. claim 36 over Djayaprawira, Aoyanagi, Mauri, and C.Y. Chou et al., "Microstructure and Magnetoresistance of MgO Thin Film with CoFeB and CoFeC Underlayers," Journal of Magnetism and Magnetic Materials, 310 (2007), 2245–47; and

3. claim 38 over Djayaprawira, Aoyanagi, Mauri, and Ngan (US 5,707,498, Jan. 13, 1998).

The Examiner has withdrawn the final rejection of claims 34, 36, 38, and 45 under 35 U.S.C. § 112(a) or 35 U.S.C. § 112 (pre-AIA), first paragraph. Advisory Act. 2.

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[2] Appellants identify the real party in interest as Canon ANELVA Corporation. Appeal Br. 2.

Appellants do not present separate arguments in support of patentability of dependent claims 36, 38, or 45. *See generally* Appeal. Br. 4–7. Accordingly, we decide the appeal as to all claims on the basis of independent claim 34 (*see* 37 C.F.R. § 41.37(c)(1)(iv)(2014)), reproduced below:

> 34. A method of manufacturing a magnetoresistive device having a first ferromagnetic layer, an MgO layer which is above the first ferromagnetic layer, and a second ferromagnetic layer which is above the MgO layer, the method comprising:
>
> (a) providing a film forming chamber comprising a[n] MgO target and a target comprising a substance which is an element selected from the group consisting of Ta, Ti, Mg, Zr, Nb, Mo, W, Cr, Mn, Hf, V, Si, Al and Ge,
>
> (b) opening a first shutter which shields the target comprising the substance, while closing a second shutter which shields the MgO target, and closing a third shutter which shields a substrate from the MgO target and the target comprising the substance,
>
> (c) performing a first sputtering process for sputtering the target comprising the substance and for adhering the substance to a component of the film forming chamber and for adhering the substance to the third shutter;
>
> (d) performing a pre-sputtering process after terminating the first sputtering process of step (c), the pre-sputtering process comprising closing the first shutter, while the second shutter and the third shutter remain closed, and sputtering by applying a high-frequency power to the MgO target; and
>
> (e) performing a process for forming the MgO layer on the substrate, after the pre-sputtering process of step (d), the process for forming the MgO layer comprising opening the second shutter, carrying out a second sputtering process, wherein a high frequency power is applied to the MgO target in the film forming chamber, and opening the third shutter to form the MgO layer on the substrate.

Appeal Br. 9 (Claims App'x).

The Examiner finds Djayaprawira discloses a method of making a magnetoresistive device comprising an MgO layer disposed between first and

second ferromagnetic layers, and a Ta layer. Final 5. The Examiner finds Djayaprawira's method includes a step of sputtering a Ta target in first chamber 27A wherein Ta adheres to a component of the chamber (as recited in claim 34, step (c)), and a step of sputtering an MgO target in second chamber 27C (as recited in claim 34, step (e)). *Id.* at 6. The Examiner finds that although Djayaprawira utilizes separate chambers for the Ta and MgO sputtering steps, one of ordinary skill in the art at the time of the invention would have understood that a single chamber comprising both the Ta target and the MgO target could be utilized (as recited in claim 34, step (a)). *Id.*

Appellants argue Djayaprawira fails to teach or suggest an arrangement in which MgO and Ta are arranged in the same chamber and, therefore, does not teach or suggest forming an MgO film in a chamber having Ta adhered to the inside walls thereof by a prior step of sputtering a Ta target. Appeal Br. 6.

Appellants' argument is not persuasive because the Examiner's findings are supported by Djayaprawira paragraphs 35 and 36, which disclose that each of chambers 27A, 27B, and 27C is provided with four or five targets and that the described embodiment of providing Ta and MgO in separate chambers is merely exemplary. In the multilayer structure shown in Figure 1 of Djayaprawira, Ta is formed as the first layer and MgO is formed as the sixth layer. *See* Djayaprawira Fig. 1, ¶ 30. Therefore, the Examiner had a reasonable basis for finding that in the modified Djayaprawira method wherein a single chamber (e.g., 27C) comprising both Ta and MgO targets is utilized, Ta would adhere to a component of chamber 27C during formation of the first (Ta) layer and be present during the subsequent step of sputtering the MgO target to form the sixth (MgO) layer.

The Examiner finds that although Djayaprawira does not disclose a step of pre-sputtering the MgO target (as recited in claim 34, step (d)), it would have been

obvious to include this step in Djayaprawira's method based on Aoyanagi's teaching of pre-sputtering an MgO target with a closed shutter, and then opening the shutter during the step of sputtering the MgO target to form an MgO film on the substrate. Final 6. The Examiner finds neither Djayaprawira nor Aoyanagi discloses or suggests the use of separate shutters for the target and the substrate (as required by claim 34). *Id.* The Examiner finds Mauri discloses a method of making a magnetoresistive device wherein the substrate and the target have separate shutters. *Id.* The Examiner finds one of ordinary skill in the art at the time of the invention would have modified the method of Djayaprawira, as modified by Aoyanagi, to include separate shutters for each of the MgO target, the Ta target, and the substrate in order to protect them from contamination. *Id.* at 7.[3]

Appellants argue none of the references discloses or suggests the use of a separate shutter for each individual target and, therefore, even if the references were combined, the claimed method would not result. Reply Br. 2.

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[3] The Examiner's findings with respect to the teachings of the prior art are also summarized in the Answer as follows:

> Djayaprawira teaches depositing a ferromagnetic layer, MgO layer and another ferromagnetic layer, [and] also teaches depositing Ta layer and then MgO layer. Combination of Aoyanagi and M[a]uri is to teach it is known in the art to measure the flux and conditioning (pre-sputtering) by first having all the shutters closed and apply high frequency power to a first target, have the target shutter open when the other target shutters and substrate shutter are closed to minimize contamination and then open the substrate shutter while the first target shutter is open and the other target shutters are closed. Closing all the shutters when reaching to the desire film thickness, and repeat it for the second target to deposit the second layer of film on the substrate.

Ans. 2–3.

Appellants' argument is not persuasive because the Examiner's findings supported by Mauri's disclosure. Mauri teaches that in an initial step, the target shutter and substrate shutter are both closed, and the target, substantially pure Mg metal (Mauri ¶ 36), is sputtered in the presence of pure Ar to eliminate any oxidized material from the target. *Id.* ¶ 41. Mauri discloses that, with the target shutter open and substrate shutter closed, the target is again sputtered to condition the chamber by coating the walls with Mg metal. *Id.* ¶ 42. Mauri discloses that "[b]ecause the chamber walls are metallic and an active oxygen-gettering surface, they provide additional O_2 pumping, thus delaying the onset of target oxidation." *Id.* Mauri also discloses that the closed substrate shutter "protects the CoFe metallic film on the substrate from exposure to the sputtered Mg atoms during the chamber conditioning step." *Id.* Mauri discloses that after the conditioning step, the target shutter remains open while the substrate shutter is opened to allow reactive deposition of an MgO tunnel barrier. *Id.* ¶ 43. Mauri also discloses that "[p]rior to the process for forming the MgO tunnel barrier the other layers . . . can be deposited in the same vacuum deposition system, using sputtering targets of the appropriate material." *Id.* ¶ 36. Given Mauri's description of using both a target shutter and a substrate shutter in forming layers via sputter deposition, the Examiner had a reasonable basis for finding that when two targets are combined in a single chamber as taught by Djayaprawira, one of ordinary skill in the art would have recognized from Mauri that the use of a shutter for each target would be beneficial to minimize cross-contamination of the substantially pure target materials. *See* Ans. 3.

Appellants argue Mauri describes "a reactive sputter to form an MgO layer by oxidizing Mg metal with oxygen gas by using a target of the Mg metal." Appeal Br. 6. Appellants argue Mauri performs a conditioning step wherein Mg is

adhered to the chamber walls for the purpose of removing oxygen gas left by the reactive sputter. *Id.* at 7. Appellants contend one of ordinary skill in the art at the time of the invention would not have had a reason to modify Djayaprawira's method to perform Mauri's conditioning step since oxygen gas does not exist in Djayaprawira's method which utilizes an MgO target. *Id.*

As explained in the Answer, this argument is not persuasive because it fails to address the Examiner's findings with respect to the understanding of the ordinary artisan from the *combined* teachings of Mauri and Aoyanagi with respect to pre-sputtering/conditioning. *See* Ans. 2–3. More specifically, Appellants fail to explain why the Examiner's findings are erroneous or unreasonable based on the ordinary artisan's consideration Mauri in combination with Aoyanagi, which explicitly describes a pre-sputtering/conditioning step using an MgO target. *See* Final 6–7.

In sum, for the reasons stated in the Final Office Action, the Answer and above, Appellants have not argued persuasively that a preponderance of the evidence fails to support the Examiner's conclusion of obviousness. *Ex parte Frye*, 94 USPQ2d 1072, 1075 (BPAI 2010) ("Filing a Board appeal does not, unto itself, entitle an appellant to *de novo* review of all aspects of a rejection. If an appellant fails to present arguments on a particular issue — or, more broadly, on a particular rejection — the Board will not, as a general matter, unilaterally review those uncontested aspects of the rejection.") (cited with approval in *In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011) ("[I]t has long been the Board's practice to require an applicant to identify the alleged error in the examiner's rejections.")).

Because Appellants have not identified reversible error in the Examiner's obviousness determination, we sustain the rejections of claims 34, 36, 38, and 45.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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NAGUMO, *Administrative Patent Judge*, dissenting.

I respectfully dissent.

The problem addressed by the invention is that MgO sputtering targets, which are used to form thin insulating layers between ferromagnetic layers in magnetoresistance-effect elements (Spec. 3, ¶ 6), are porous materials that easily absorb water and oxidizing gases such as oxygen (*id.* at 36, ¶ 62). The adsorbed water and gases are said not to be exhausted easily, even at the operating pressures of 10^{-7} Pa in the deposition chambers, and are released upon sputtering. (*Id.*) These gases are considered to oxidize the surface of ferromagnetic layers exposed on the substrate, and to degrade MgO insulating layers formed on the ferromagnetic layers. (*Id.*) Sputtering a "getter" layer of tantalum or others of the metals recited in step (a) of claim 34 over the inside of the chamber in which the MgO is to be sputtered provides a trap for the gases released during the pre-sputtering and sputtering steps of MgO recited in steps (d) and (e). (*Id.* at 36–37, ¶¶ 63–64.)

There is no doubt that the routineer *could* have put the required getter targets into the same chamber as the MgO in the apparatus taught by Djayaprawira, and that they *could* have adjusted the shutters as required by claim 34. However, as Appellants argue (Appeal Br. 5–6), the Examiner has not directed our attention to any suggestion by Djayaprawira to do so. Aoyanagi and Mauri are similarly deficient. The only place in the present record where a reason to conduct the process claimed by Appellants is to be found is in Appellants' own specification. Such hindsight reconstruction of the claimed invention does not, however, establish obviousness in view of the prior art.

Accordingly, on the present record, I would reverse the rejections of record, and I dissent, with respect.